1) Those of concentric spheroidal form produced by foreign inclusions.
2) Those where the varioles were formed by the partial resorption of fragments of the locally solidified magma.
3) The so-called "pudding granites," due to a concretionary action.
4) Those varioles which are primary structural forms of the magma, or are due to endomorphic contact action.

The *conditions* requisite for the formation of varioles are:

1) A difference in the basicity within the magma.
2) The cores must be near each other.
3) There must be a difference in temperature between the core and the magma.
4) The temperature must be high enough to aid resorption but not sufficient to permit the complete resorption of the fragments.

While the work is occupied primarily with a study of the origin of macrovariolitic rocks, it is full of incidental studies of the minerals encountered. This is especially true of zircon, the feldspars, and perthitic intergrowths, while there are many suggestive points on phenomena frequently seen in quartz, apatite, hornblende, etc. On the whole the work is an example of a careful, exhaustive study of a circumscribed problem.

EDWARD B. MATHEWS.

On the Banded Structure of Some Tertiary Gabbros in the Isle of Skye. By SIR ARCHIBALD GEIKIE and J. J. H. TEALL. Quart. Jour. Geol. Soc., November, 1894. Vol. I., pp, 645–659. Pls. XXVI., XXVII., XXVIII.

THE importance of this study of the Tertiary gabbros of Skye is twofold, as pointed out by the author: First, as a contribution to our knowledge of the structures which may be assumed by igneous rocks at the time of their solidification, or prior to their consolidation. Second, as an aid to the elucidation of some of the most perplexing problems in the study of the crystalline schists.

The rocks described are part of the volcanic complex which forms the picturesque group of mountains known as the Cuillin Hills in the southern portion of the Isle of Skye—a vast aggregation of indurated tuffs, agglomerates, lava-flows, besides intruded bodies that have broken

through the earlier accumulations, and have been exposed to view by subsequent erosion.

The gabbros in question are among the more recent rocks, though not the latest, and exhibit no trace of crushing, recrystallization or other signs of metamorphism. They appear to have remained in the condition in which they originally crystallized. Moreover, no great terrestrial disturbance has affected the region since the time of their eruption. They are said to form sheets or sills varying from a few feet to many yards in thickness, each band consisting of many parallel layers of lighter and darker material, which correspond to the trend of the sheet itself. The component layers vary in thickness from mere pasteboard-like laminæ to beds a yard or more in thickness. They are sometimes as parallel and regular as sedimentary deposits. But, traced along the strike, they are apt to vary in thickness and even to die out. Their appearance is quite like the banding of gneisses.

The microscopical study of these rocks shows their mineral constituents to be like those of normal olivine-gabbros, and the differences between the light and dark bands to be due to differences in the relative proportions of the minerals.

The crystallization of the mass is continuous across the bands, the individual crystals interlocking in such a manner as to make it evident that all crystallized from a molten magma at approximately one time. The white bands in some cases consist almost entirely of labradorite, while the extreme dark bands are made up of augite and titaniferous magnetite.

The cause of these differences in composition of alternate layers of gabbro is considered to be a differentiation of the magma previous to its intrusion among the rocks in which it consolidated. The banding is the result of the intrusion of a heterogeneous magma. The original shapes of the more or less differentiated masses that composed this heterogeneous magma are not known, their intrusion through fissures would produce a laminated arrangement.

A comparison of these rocks with certain ancient gneisses is drawn, especially with the anorthosite rocks of Canada, and with certain ultrabasic portions of the Lewisian gneiss of Scotland; the similarity in their structures is pointed out, and a correspondence in their origin is suggested.

The analogy between the banding in both these kinds of rocks strengthens the view now generally held by geologists, that the older

gneisses are mainly rocks of igneous origin. While recognizing the undoubted evidence of secondary dynamic action in many regions, and the absence at present of criteria by which original and secondary structures may be discriminated, the authors are strongly of the opinion that much of the banding of gneisses, as distinguished from mere foliation, may be an original structure due to the conditions in which the igneous magma was erupted and consolidated.

The necessity of establishing the prevalence of such differentiated lamination in basic rocks, and of recognizing its occurrence to any considerable extent in granitic masses, is self-evident after the bearing of such facts on the nature and origin of the ancient gneisses has been so clearly set forth.

JOSEPH P. IDDINGS.

Preliminary Report on the Geology of South Dakota. By J. E. TODD, State Geologist. (South Dakota Geol. Surv., Bul. No. 1, 172 pp., 5 plates, Prelim. Geol. Map. Sioux Falls, 1895).

Summaries of the progress up to date along a particular line of work, or of the knowledge of the geology of particular regions are always welcome. This is particularly true when the report covers a region of so wide and varied interest as South Dakota and one the literature of which is so badly scattered. Since the early work of Hayden in the eastern and of Newton and Jenny in the western half of the state the papers on the geology of South Dakota which have appeared have been fragmentary only. They have, however, modified our ideas of the geology of the region in many important regards. As a foundation for the future work of the Geological Survey Todd has brought together in convenient form all this mass of information and has added to it, as a result of his several years work in the region, a great deal that is now for the first time published.

Among the new points which may be noticed are, the recognition of the Silurian as present in the Deadwood section and the pointing out of the beds which must represent the Devonian if it be at all present. A number of caves in the Carboniferous are described in detail. In one of them, Wind cave, is a curious calcite formation called "box-work." The peculiar dome-like surface of the Purple Limestone, it is suggested, may be due to the leaching out of salt beds of irregular thickness below. The marine origin of the Dakota is